Experiences of Fatigue at Sea

Zhao, Zhiwei; Jepsen, Jørgen Riis; Chen, Zhonglong; Wang, Huanxin

Published in:
Journal of Biosciences and Medicines

DOI:
10.4236/jbm.2016.43011

Publication date:
2016

Journal of Biosciences and Medicines, 2016, 4, 65-68
Published Online March 2016 in SciRes. http://www.scirp.org/journal/jbm
http://dx.doi.org/10.4236/jbm.2016.43011

Experiences of Fatigue at Sea—A Comparative Study in European and Chinese Shipping Industry

Zhiwei Zhao[1,2], Jorgen Riis Jepsen[2], Zhonglong Chen[1], Huanxin Wang[1]

[1]Seafarers Development International Research Centre, Dalian Maritime University, Dalian, China
[2]Centre of Maritime Health and Society, University of Southern Denmark, Odense, Denmark
Email: zhao@health.sdu.dk

Received 25 December 2015; accepted 21 March 2016; published 24 March 2016

Abstract

Fatigue has negative impacts on the general working population as well as on seafarers. In order to study seafarers' fatigue, a questionnaire-base survey was conducted to gain information about potential risk factors for fatigue and construct indexes indicating fatigue. The study applies T-test to compare strata of seafarers to analyse work and sleep patterns in global seafaring. Qualitative analysis are also employed to explore the impacts of fatigue on seafarer's occupational health and safety.

Keywords

Fatigue, Seafarers, Work and Sleep Patterns, T-Test, Stepwise Regression Analysis

1. Introduction

Among the general working population, fatigue has been associated with accidents and injuries (Allen *et al*., 2008; Bonnet and Arand, 1995) [1] [2] and also linked to ill health (Andrea *et al*., 2003; Barger *et al*., 2005; Van Amelsvoort *et al*., 2002) [3]-[5] as well as to poorer work performance (Beurskens *et al*., 2000; Charlton and Baas, 2001) [6] [7], sick leave and disability (Janssen *et al*., 2003) [8]. In shipping the extent of research on fatigue is more limited. The Cardiff Seafarers' Fatigue Research Programme (Smith *et al*., 2001, 2003 and 2006) [9]-[11] set out to remedy this and concluded that many of the risk factors for fatigue found in other industries were present in combination in maritime work (Allen *et al*., 2005 and 2006) [12] [13]. They confirmed the importance of fatigue as a factor in accident causation (Wellens *et al*., 2005) [14] and ill health (Wadsworth *et al*., 2008) [15]. In order to optimize the legal framework internationally and nationally, and to promote safe and healthy sleep patterns in merchant shipping, it is important to explore the current provisions for sleep at sea in an international perspective and whether they are adequate and also understand the symptoms and impacts of fatigue on seafarers.

2. Method

454 and 483 seafarers in two European and two Chinese shipping companies, respectively, answered a ques-

How to cite this paper: Zhao, Z.W., Jepsen, J.R., Chen, Z.L. and Wang, H.X. (2016) Experiences of Fatigue at Sea—A Comparative Study in European and Chinese Shipping Industry. *Journal of Biosciences and Medicines*, **4**, 65-68.
http://dx.doi.org/10.4236/jbm.2016.43011

tionnaire and 51 in-depth interviews were carried out in order to further elaborate into the issue. All interviews were tape recorded. The survey and interviews participants' anonymity and data confidentiality are kept intact.

Questionnaire was a revised version based on the questionnaire designed and employed in the Cardiff Seafarers' Fatigue Research Programme. The questions were selected from the original questionnaire with an aim of exploring long-term fatigue and related factors in order to explore the question: how organisational practices and individual factors influence fatigue, what methods should be applied for preventing and managing seafarers' fatigue and what are the effect of applying different strategies. In addition to DEMOGRAPHICS, the questionnaire consists of 6 sections, focusing on seafarers JOB/VESSEL, HOURS OF WORK AND REST, FATIGUE AT SEA, ABOUT THE WORK, SLEEP PATTERNS & HEALTH-RELATED BEHAVIOURS, TRAVEL TO AND FROM THE VESSEL. 937 questionnaires were collected altogether, among which, 454 questionnaires were collected from European, accounting for 48.5% of the total number and 483 from China with a proportion of 51.5%. 506 questionnaires are filled out by officers representing 54.0% of the sum and 390 by ratings constituting 41.6%. Questionnaires from Deck department take up 52.1% with a number of 488 and others from Engine department make up 379 of the total number. 99.1% respondents are male (n = 929) whose average age is 36.07 (media = 33, range = 19 to 69). Indexes indicating tiredness at work, sleep quality and distress at work were constructed by using scale reliability (Cronbach' $\alpha > 0.8$) and weighted mean. Strata were compared by application of a T-test. Stepwise regression analysis were carried out to explore the potential risk factors of fatigue. Additionally, qualitative data collected from 51 in-depth interviews were analyzed to interpret the symptoms and also impacts on seafarers of fatigue.

3. Result

As **Table 1** shows, compared to contract work time, European and Chinese seafarers had higher actual weekly

Table 1. Descriptive statistics.

	Chinese seafarers (Mean)	European seafarers (Mean)	Officers (Mean)	Ratings (Mean)
Age	34.18 (n = 461, SD = 9.16, S.E = 0.43)	38.06 (n = 443, SD = 10.49, S.E = 0.49)	36.66 (n = 486, SD = 9.81, S.E = 0.45)	35.57 (n = 379, SD = 10.07, S.E = 0.52)
Sailing Age	8.36 (n = 469, SD = 7.78, S.E = 0.36)	13.58 (n = 405, SD = 9.30, S.E = 0.46)	11.59 (n = 480, SD = 9.16, S.E = 0.42)	9.81 (n = 364, SD = 8.42, S.E = 0.44)
Contract work hours (weekly)	56.93 (n = 294, SD = 9.42, S.E = 0.55)	58.57 (n = 341, SD = 14.05, S.E = 0.76)	59.20 (n = 325, SD = 12.26, S.E = 0.68)	56.34 (n = 284, SD = 11.90, S.E = 0.71)
Actual work hours (weekly)	60.40 (n = 283, SD = 10.58, S.E = 0.63)	63.58 (n = 382, SD = 14.11, S.E = 0.72)	64.52 (n = 346, SD = 12.62, S.E = 0.68)	59.73 (n = 291, SD = 12.72, S.E = 0.75)
Amount of time at sea	7.91 (n = 367, SD = 1.23, S.E = 0.07)	5.32 (n = 367, SD = 1.82, S.E = 0.10)	6.13 (n = 408, SD = 2.26, S.E = 0.11)	7.29 (n = 298, SD = 1.51, S.E = 0.87)
Actual sleep	8.06 (n = 444, SD = 1.61, S.E = 0.07)	8.06 (n = 441, SD = 1.94, S.E = 0.09)	7.82 (n = 484, SD = 1.76, S.E = 0.08)	8.38 (n = 365, SD = 1.78, S.E = 0.09)
Ideal sleep	8.68 (n = 457, SD = 1.22,S.E = 0.06)	7.76 (n = 442, SD = 1.52, S.E = 0.07)	8.13 (n = 490, SD = 1.42, S.E = 0.06)	8.36 (n = 373, SD = 1.50, S.E = 0.08)
Sleep quality	1.24 (n = 472, SD = 0.59, S.E = 0.03)	0.86 (n = 452, SD = 0.47, S.E = 0.02)	1.16 (n = 501, SD = 0.56, S.E = 0.03)	0.93 (n = 386, SD = 0.55, S.E = 0.03)
Distress at work	1.39 (n = 420, SD = 0.81,S.E = 0.04)	0.73 (n = 424, SD = 0.61, S.E = 0.03)	1.21 (n = 475, SD = 0.79, S.E = 0.04)	0.87 (n = 342, SD = 0.74, S.E = 0.04)
Tiredness at work	2.17 (n = 449, SD = 0.91, S.E = 0.04)	1.71 (n = 431, SD = 0.82, S.E = 0.04)	2.09 (n = 472, SD = 0.87, S.E = 0.04)	1.78 (n = 374, SD = 0.89, S.E = 0.05)

work hours, respectively (European: $p < 0.001$, mean difference = −4.14, 95%CI = (−5.31, −2.96), Cohen's d = −0.29, 95%CI = (−0.44, −0.14); Chinese: $p < 0.001$, mean difference = −3.73, 95%CI = (−4.80, −2.66), Cohen's d = −0.41, 95%CI = (−0.58, −0.24)). It can be seen from the table, there was no significant difference between European seafarers' actual sleep and their ideal amount of sleep ($p = 0.005$, mean difference = −0.28, 95%CI = (−0.80, −0.56), Cohen's d = 0.16, 95%CI = (0.03, 0.29)). However, Chinese seafarers' actual sleep was less than ideal amount of sleep ($p < 0.001$, mean difference = −0.68, 95%CI = (0.09, 0.48), Cohen's d = −0.51, 95%CI = (−0.64, −0.37)). A similar situation emerged between Ratings and Officers, that Ratings' actual sleep and ideal sleep length were not significantly different while Officers' actual sleep length was less than their expectation. In addition, Chinese seafarers' ideal sleep length was longer than that of European seafarers ($p < 0.001$, mean difference = −0.92, 95%CI = (−1.10, −0.74), Cohen's d = −0.67, 95%CI = (−0.80, −0.53)). Compared to European seafarers, Chinese seafarers experienced lower quality of sleep and suffered more distress and tiredness at work (Sleep quality: $p < 0.001$, mean difference = −0.38, 95%CI = (−0.45, −0.31), Cohen's d = −0.71, 95%CI = (−0.84, −0.58); Distress: $p < 0.001$, mean difference = −0.67, 95%CI = (−0.76, −0.57), Cohen's d = −0.94, 95%CI = (−1.10, −0.79); Tiredness: $p < 0.001$, mean difference = −0.46, 95%CI = (−0.58, −0.35), Cohen's d = −0.54, 95%CI = (−0.68, −0.41)). A similar situation can be detected between Ratings and Officers that Officers had poorer sleep quality and suffered more distress and tiredness than Ratings did at work. Concerning seafarers fatigue in general, the analysis shows that fatigue is related to a wide range of issues and can influence seafarers health and safety in a negative way. Seafarers suffered from a number of accurate and chronic health problems.

4. Conclusion

According to the analysis, conclusions can be drawn: significant difference can be found between contract work hours and actual work hours as well as between actual sleep and ideal sleep, which indicate suboptimal work and sleep patterns in global seafaring; there are significant differences in between strata of seafarers (rank, nationality) and it suggests that work hours and sleep are the factors which relate to seafarers' fatigue; current management of fatigue risks is inadequate and seafarers' health and safety are negatively influenced by fatigue; the shipping industry can do more for its seafarers to have a healthier and safer working environment.

References

[1] Allen, P.H., Wadsworth, E.J. and Smith, A.P. (2008) Seafarers' Fatigue: A Review of the Recent Literature. *International Maritime Health*, **59**, 81-92.

[2] Bonnet, M.H. and Arand, D.L. (1995) We Are Chronically Sleep Deprived. *Sleep*, **18**, 908-911.

[3] Andrea, H., Kant, I.J., Beurskens, A.J.H.M., Metsemakers, J.F.M. and Van Schayck, C.P. (2003) Associations between Fatigue Attributions and Fatigue, Health, and Psychosocial Work Characteristics: A Study among Employees Visiting a Physician with Fatigue. *Occupational and Environmental Medicine*, **60**, 99-104. http://dx.doi.org/10.1136/oem.60.suppl_1.i99

[4] Barger, L.K., Cade, B.E., Ayas, N.T., Cronin, J.W., Rosner, B., Speizer, F.E., *et al*. (2005) Extended Work Shifts and the Risk of Motor Vehicle Crashes among Interns. *New England Journal of Medicine*, **352**, 125-134. http://dx.doi.org/10.1056/NEJMoa041401

[5] Van Amelsvoort, L.G.P.M., Kant, I.J., Beurskens, A.J.H.M., Schroer, C.A.P. and Swaen, G.M.W. (2002) Fatigue as a Predictor of Work Disability. *Occup. Environ. Med*, **59**, 712-713. http://dx.doi.org/10.1136/oem.59.10.712

[6] Beurskens, A.J.H.M., Bultmann, U., Kant, I.J., Vercoulen, J.H.M.M., Bleijenberg, G. and Swaen, G.M.H. (2000) Fatigue among Working People: Validity of a Questionnaire Measure. *Occupational and Environmental Medicine*, **57**, 353-357. http://dx.doi.org/10.1136/oem.57.5.353

[7] Charlton, S.G. and Baas, P.H. (2001) Fatigue, Work-Rest Cycles, and Psychomotor Performance of New Zealand Truck Drivers. *Journal of Psychology*, **30**, 32-39.

[8] Jansen, N.W.H., Kant, I., Van Amelsvoort, L.G.P.M., Nijhuis, F.J. and Van den Brandt, P.A. (2003) Need for Recovery from Work: Evaluation Short-Term Effects of Working Hours, Patterns and Schedules. *Ergonomics*, **46**, 664-680. http://dx.doi.org/10.1080/0014013031000085662

[9] Smith, A.P., Lane, T. and Bloor, M. (2001) Fatigue Offshore: A Comparison of Offshore Oil Support Shipping and the Offshore Oil Industry. Seafarers International Research Centre (SIRC)/Centre for Occupational and Health Psychology, Cardiff University, Cardiff.

[10] Smith, A.P., Lane, T., Bloor, M., Allen, P., Burke, A. and Ellis, N. (2003) Fatigue Offshore: Phase 2. The Short Sea and Coastal Shipping Industry. Seafarers International Research Centre (SIRC)/Centre for Occupational and Health

Psychology, Cardiff University, Cardiff.

[11] Smith, A., Allen, P. and Wadsworth, E. (2006) Seafarers' Fatigue: The Cardiff Research Programme. MCA, Southampton.

[12] Allen, P.H., Wellens, B.T., McNamara, R. and Smith, A. (2005) It's Not All Plain Sailing. Port Turn-Arounds and Seafarers' Fatigue: A Case Study. In: Bust, P.D. and McCabe, P.T., Eds., *Contemporary Ergonomics*, Taylor & Francis, London, 563-567.

[13] Allen, P.H., Wadsworth, E. and Smith, A. (2006) The Relationship between Recorded Hours of Work and Fatigue in Seafarers. In: Bust, P.D., Ed., *Contemporary Ergonomics*, Taylor and Francis, 546-548.

[14] Wellens, B., McNamara, R., Allen, P. and Smith, A. (2005) Collisions and Collision Risk Awareness at Sea: Data from a Variety of Seafarers. In: Bust, P.D. and McCabe, P.T., Eds., *Contemporary Ergonomics*, Taylor & Francis, London, 573-577.

[15] Wadsworth, E.J., Allen, P.H., McNamara R.L., Wellens, B.T. and Smith, A.P. (2008) Fatigue and Health in a Seafaring Population. *Occupational Medicine*, **58**, 198-204. http://dx.doi.org/10.1093/occmed/kqn008